The Journal
of the
Mysore Agricultural
and
Experimental Union.

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Twelfth Annual Report of the Mysore Agricultural and Experimental Union, 1930.

It gives me great pleasure to welcome you to the Twelfth Annual Meeting of the Mysore Agricultural and Experimental Union, and to submit the report for the year 1929.

The Union was formed in the year 1918. According to its constitution, the membership of the Union is open to such persons as have received training in some recognized agricultural institution, to the members of the staff of the Mysore Agricultural Department and to such others as have been approved by the Committee for membership. The main object was to bring together the men trained in our Agricultural School, the staff of the Department and the more progressive among our agriculturists in the effort to improve the State's agriculture.

The special feature of the work of the Union has been a definite annual programme of experimental work. The experiments are confined mainly to the testing of improvements recommended by the Agricultural Department with a view to ascertaining their applicability under different soil and climatic conditions. These co-operative experiments were started by us almost twelve years ago. Their importance has been recognized recently by the Royal Commission on

Indian Agriculture who recommend the system for wider adoption in India.

The accompanying statement shows in detail the increase in membership since the last meeting and the number and nature of the experiments undertaken by members during the years 1928, 1929 and 1930. Since the last annual meeting, membership has increased by 145. It is now 380. There is a steady increase in the number of members undertaking experimental work. Sixty-seven members have undertaken work this year out of 303 non-official members. Only 22 per cent of the non-official members are yet taking an active part in the work of the Union.

Experimental Work undertaken by Members during the three years 1928, 1929 *and* 1930.

	1928	1929 Dec.	1930 May.
No. of members on the roll ..	235	..	380
No. of members undertaking work ..	15	54	67
Trial of Implements ..	..	19	..
Trial of Varieties of Seeds :			
Ragi ..	6	26	28
Groundnut ..	6	12	24
Paddy ..	..	19	34
Sugarcane ..	3	6	21
Cotton ..	..	..	6
Manurial Experiments :			
Sugarcane ..	2	16	19
Paddy ..	12	22	26
Treatment against Insect Pests :			
Pests of Stored Pulses ..	..	..	5
Sugarcane Borer ..	..	..	3
Coffee Borer ..	..	..	2
Cardamom Caterpillar ..	..	..	2
Lime Tree Borer ..	..	..	1
Control of Fungus Diseases ..	..	2	6
Sunflower Ensilage ..	..	..	15

Discussion of Results.

RAGI AND GROUNDNUT VARIETAL TESTS.

The year was very unfavourable for dry crops. The sowing rains failed with the result that the seeds were either not sown at all,

or where sown the young seedlings dried up for want of rains. At Siddlaghatta on Mr. Hampiah's plots, ragi suffered severely from drought as in many other places. The only point worthy of note in the report sent is that H 22 has proved to be the most drought-resistant variety of all the varieties tried. At Tumkur also the yield is very low due to the season, but H 22 and H 40 ragis have done the best. At Davangere, H 658 has done the best, H 22 and H 40 being the next in order. The results, meagre as they are, indicate clearly that no one variety can be said to be the best in all places and that local trials alone can decide which is the best under existing local conditions.

H.G. No. 1 groundnut has yielded nearly three times as much as the local variety in Tumkur, and four pallas more than the local at Kamasamudram, Kolar. The local variety and small Japan have done better at Anekal and Kolar respectively.

Paddy Varietal Tests.

Out of nineteen members who received seed, four have sent in reports of results. G.E.B. 24 was the only variety distributed. This variety has given from two to three pallas more grain per acre as a monsoon crop than the varieties grown locally.

In some cases due to the uncertain water supply in tanks the experiment was not attempted.

Sugarcane Varietal Tests.

Out of six members who received seed, only two have reported. The results as reported are very incomplete and it is not safe to draw any conclusions from them. Two members, who had laid out the plots properly and taken a great deal of trouble in the beginning, neglected the experiment at harvest time. The remaining two members have used the entire crop of the experimental plots for seed for the next crop.

Paddy Manurial Trials.

Out of 22 members who received manures for trial, eight members have yet reported results. Ammophos, 20-20 grade, has proved to be the best manure for paddy in all these trials excepting the one in which the mixture of Am_2SO_4 and Superphosphate has given a slightly better yield. The use of Ammophos has resulted in an increased yield of from $1\frac{1}{2}$ to $10\frac{1}{2}$ pallas of paddy per acre representing a net profit of from Rs. 12 to 84 per acre. In one of the trials

Leunaphos has given better yield than Ammophos. In another trial, the mixture of Am_2SO_4 and Super has yielded six pallas of paddy more per acre than Leunaphos and the use of Leunaphos has actually resulted in a small loss. These results will have to be discussed carefully during the present meeting before they are published. The use of artificial manures has resulted in an increased quantity of straw also in all instances, a matter of no small importance in view of the necessity to develop our fodder resources. Mr. A. V. Kuppuswamy Mudaliar has conducted a series of interesting manurial trials on varieties of paddy. The results, however, are not strictly comparable but clearly indicate the value of Superphosphate and Ammophos for paddy. A noteworthy point in these manurial trials is that where the variety of paddy used is also an improved variety, the yield of paddy per acre is considerably higher than where the local variety was used.

Sugarcane Manurial Trials.

Out of 16 members who received manures, only two members have reported result yet. The use of Ammophos (13-53 grade) supplemented with Am_2SO_4 has resulted in an increased yield of 50 maunds of jaggery per acre.

Spraying against Black Rot of Coffee.

Messrs. S. Pais and A. Pais who conducted these trials have very successfully sprayed against Black Rot of Coffee. The sprayed plots were not harvested separately but the value of spraying was so obvious in the crop that Mr. S. Pais writes that spraying has ceased to be an experiment and has become part of the regular annual cultural operation.

Trial of Satara Ploughs.

A great feature of these trials is the large number of reports of work received. Out of 19 members who received ploughs 15 have sent in reports. The remaining four members received the ploughs too late for trial last season and are therefore using them this year.

The two most popular ploughs in the eastern part of the State are the Kolar Mission plough manufactured by Messrs. John Deere Plow Co. of Chicago and the Mysore plough designed by our Agricultural Engineer and manufactured by Messrs. Ransomes Jefferys & Co., England. The Cooper Engineering Works, Satara, have recently manufactured ploughs on these two models calling them the

Mysore and Bangalore ploughs, the former being designed after the Ransomes plough and the latter after the Kolar Mission plough. Ten Ransomes type bar share ploughs and nine Bangalore ploughs were sent to our members for trial. The results as reported by the members will be discussed in detail but they may be summarized here. One point must however be borne in mind in considering the reports. The ploughs do not, as stated by the manufacturers, represent their finished product. They were made for trial. As received here, no two ploughs were alike.

The Bangalore Plough.

The work of this plough was compared with that of the Kolar Mission plough. Two members state that while the furrow was clean cut, the ploughed soil was not turned over properly with the result that it returned partly into the furrow. Two members state that the plough is not steady at work. The quality of the metal used is considered very inferior. Mr. N. Krishniengar's opinion is that the mould board being made of ordinary mild steel plate, does not, in the beginning, scour so well as the K.M. plough but after a few days' use in sandy soil it wears to the proper shape and gets polished when there is no difference in its scouring properties as compared with the K.M. plough. Some defects which have been reported upon are :—

(*a*) The beam and the sole of the plough are not in a line. The plough therefore drags to a side leaving unploughed ridges.

(*b*) The beam is not made of good wood. It split away in a few days' use. The other parts of the plough also may not stand the severe strain that a plough is subjected to, so well as those of the K. M. plough.

The general opinion seems to be that if the defects pointed out are rectified and better material is used and provided also that the price compares favourably with the K. M. plough, the Bangalore plough might take the place of the Kolar Mission plough. In its present condition, in points of penetration of the share into the soil, the steadiness at work and turning over of the soil as well as of the quality of material used, the Bangalore plough is inferior to the Kolar Mission plough.

The Mysore Plough.

This was compared with the Ransomes Mysore plough. The defects pointed out are :—

(1) The furrow slice is not turned over properly ; the ploughed soil partly returns to the furrow.

(2) The penetration of the bar share is not so good as that of the Ransomes plough.

(3) The plough being less steady at work, shakes much and at such times the ploughed soil returns to the furrow.

(4) The share wears out much sooner than that of the Mysore plough. The maximum area ploughed is reported to be 11 acres and the bar wore out fully.

(5) The iron handle is considered inconvenient to handle. Wooden grips are preferred and it is suggested that these should be thicker than the present ones.

(6) The screw adjustment of the bar does not facilitate easy adjustment on the field and requires frequent attention. The wedge arrangement of the Ransomes plough is preferred.

(7) The inferior quality of metal used and the beam are mentioned.

The general impression is that the plough has to be considerably improved before it can replace the Ransomes Mysore plough.

It is obvious from the results just discussed that a good deal of painstaking and accurate experimental work has been done by the members. But it is also obvious that there are many lapses. There is a great deal of effort wasted. The importance of these field tests in the agricultural development of the country does not seem to have been sufficiently realized.

When one considers the amount of encouragement and assistance which the Union has been receiving from the Government and private companies, the kind of work done by the members makes one feel depressed. Government have sanctioned free supply of seeds and manures for trial by members up to a limit of Rs. 15 in each case. Manufacturers of manures have been placing at the disposal of the members, free of cost, fairly large quantities of manures for trial and report of results. It is true that there is considerable improvement year by year in the quantity and quality of work done by the members. But can it be said that the special facilities placed at the disposal of members are utilized properly ? The companies who supply manures, free of cost, expect the results of the trials to be communicated to them. If this condition is not satisfied the supply

will automatically stop. The Agricultural Department is not interested in supplying material free to members who are not serious enough to conduct work undertaken when there are thousands outside the Union who are willing to pay for it and who therefore seem to realize its value. It is true that experimental work is not easy. It requires a great deal of painstaking care and attention. But can we think of a body of persons better fitted to undertake this most important work of testing suggested improvements than members of this Union among whom are persons trained in agriculture and others who are the leading farmers of the State ? The importance of co-operative testing work is so fully realized in Germany that the farmers actually pay for the assistance rendered in laying out plots for trial and its supervision, and as the consequence of this demand for trained assistance, a regular farm advisory service is being formed ; whereas here, trained assistance is available at the very doors of the members who have only to utilize it fully. It seems high time that these matters are seriously considered at this meeting.

The Hassan Branch of the Union.

The members who form this branch have done very creditable work during the year. They have, with few exceptions, conducted and reported upon altogether eight trials of improved varieties of paddy and sugarcane and manuring of both the crops. Two special fieldmen were appointed by the Union for a period of four months at a total cost of Rs. 251–13–8 to help the members of the Hassan branch in the collection of results. In view of the accurate results obtained the money must be said to have been well spent. It would have been possible for the fieldmen to do more work during the period they were employed had there been more trials. The policy of assisting the local staff wherever there is a concentration of experimental work, seems to be a very sound one.

The work of the Hassan branch indicates the direction in which local organizations may be developed. As long as organizations are composed of members who are willing to undertake definite improvement work and conduct it to a successful finish to the best of their resources, the permanency and usefulness of such organizations are assured. Members of the Hassan branch have undertaken experimental work again this year. Reports received indicate that the experiments have been properly planned and plots well laid out.

The Journals of the Union.

Since the last meeting seven English numbers and thirteen Kannada numbers have been issued. Two English and two Kannada issues are under print. The paying circulation of the Journals is as follows :—

English :	Members	209	269
	Subscribers	60	
Kannada :	Members	171	316
	Subscribers	145	

The revival of the Kannada as a monthly publication has been possible due to the grant of a liberal subvention by Government. Recently Government have kindly sanctioned the subvention for a period of five years. The Kannada Journal is becoming very popular. Considering that it was revived only last year the number of subscribers and members taking it must be considered satisfactory. Recently Government have recommended the Kannada Journal for subscription by middle schools and village panchayets. Already 91 schools have been subscribing for it. Letters received from the Deputy Commissioners indicate that the village panchayets are likely to subscribe for the Journal in large numbers.

That the Kannada Journal has justified its popularity is evident from the fact that the articles published in it are being copied wholesale by the vernacular press. Mr. M. J. Narasimhan, Dr. Venkata Rao Badami and Mr. K. Bhima Rao have written special articles for this edition of our Journal and helped to increase its popularity. The Journals are not issuing as regularly as we wish but with the assistance of an Assistant in Kannada recently appointed by the Committee and the special efforts which are being made to secure articles for publication, it will be possible not only to issue them regularly but to make them even more popular and useful.

The English edition is maintaining its high standard and has built up an exchange list of which any Journal may be proud. Journals and bulletins are being received in exchange from practically all parts of the English-speaking world. This advantage is being fully utilized by some of the members. The bulletins received in exchange are being card-indexed.

The grateful thanks of the Union are due to the Government for their liberal assistance and encouragement, to the Director of Public

Instruction, the Revenue Commissioner and Deputy Commissioners of all districts for the interest they are evincing in popularizing the Kannada Journal and thereby helping the Union to continue the useful work in which it is engaged.

The thanks of the Union are due to Messrs. The Imperial Chemical Industries and Shaw Wallace & Co., for placing at the disposal of the Agricultural Chemist various kinds of fertilizers for trial by our members.

The statement of income and expenditure is appended.

N. VENKATSUBBAYA,
Secretary.

May 30, 1930.

BALANCE SHEET AS ON 31st DECEMBER 1929.

Receipts	Rs.	A.	P.	Expenditure	Rs.	A.	P.
Opening Balance..	150	12	9	Establishment ..	1,135	7	1
Admission Fee ..	327	0	0	Printing ..	801	6	0
Annual Fee ..	1,092	0	0	Expenses of Annual Meeting 1928 and Field Day, 1929 ..	481	9	6
Subscription ..	601	0	0	Value of Type-writer ..	349	8	0
Miscellaneous ..	202	8	0	Postage ..	145	0	0
Subvention ..	2,500	0	0	Miscellaneous .. (Stationery, Furniture, etc.)	142	1	6
				Total ..	3,055	0	1
				Cash on hand ..	1,818	4	8
TOTAL ..	4,873	4	9	TOTAL ..	4,873	4	9

Speech by Dr. Leslie C. Coleman, M.A., Ph.D., President of the Union, at the Twelfth Annual Meeting.

Sir Mirza Ismail and Gentlemen,

Most of you have heard me on so many occasions discuss the Agricultural problems that confront us in Mysore that I am almost ashamed to appear before you to-day in the rôle of a speaker. There is obviously nothing new that I can say to you and it is difficult to clothe the same old thoughts in new words.

It is however, Sir, the first time that you have honoured us by presiding at our Annual Meeting and it is a very great pleasure as well as a very great honour for me to be able to welcome you on behalf of the members of the Union and to thank you on their behalf for sparing the time to come here.

The Secretary in his Annual Report which you have just listened has indicated clearly the main objects of the Union's existence and the extent to which those objects have been fulfilled during the past year. Our main object may be taken to be the advancement of Mysore Agriculture in all its aspects through a close and cordial co-operation between Government agencies and private individuals directly interested in agriculture. The results may, I think, be summed up in the words "steady, if somewhat slow, progress". It will be the duty of our members to consider these results and to concert measures by which progress can be accelerated. However, I may point out here that the passing of resolutions and the concerting of measures at a meeting such as this will be of little value unless large numbers of our members are prepared to carry out a definite programme of work in co-operation with the Agricultural Department.

Notwithstanding the emphasis that has been placed upon it in many addresses and reports, the need for co-operative effort in connection with the testing of all agricultural improvements is but imperfectly realized. At present much of our demonstration work has to be of a very hesitating and tentative character simply because we have not a sufficient body of accurate local data to warrant our going full speed ahead in connection with the introduction of what we believe to be distinct improvements in agricultural methods. It is, I believe, quite out of the question for Government to establish

small stations in every taluk of the State where the results of work on our experimental farms could be tested under the extremely varied conditions of soil and climate which exist in Mysore. Demonstrations on ryots' fields should, as the expression implies, serve the purpose of giving ocular evidence to the ryots of a village that a proposed improvement whether of cultivation, manuring or seed, is worthy of their trial. Unfortunately, however, only too frequently these demonstrations have to be used as about the only source of information the Agricultural Department possesses in regard to the suitability of the proposed improvement for a particular locality. As a result of this state of affairs we not uncommonly find that we have, after several years of demonstration, to discontinue our attempt at introducing an improvement in certain areas. Even then we cannot be quite sure whether our failure has been due to an inherent defect in the improvement for the particular area or to some small lack of adjustment to local conditions. The result is a considerable waste of time and money, a matter of great importance at the present moment when every rupee spent on agricultural improvement or in fact on any sort of development work, should be made to give the greatest possible return in increasing the prosperity of our people. Even more important than this is the impression created by each failure in the minds of a conservative agricultural population, for each failure leads to an increased unwillingness to try new methods which may be subsequently recommended.

As I have already pointed out, it would be impossible under present conditions for Government to finance any thing like all the testing work that is required. We must obtain the co-operation of our leading agriculturists for the work if we are to make rapid progress. What are the difficulties that stand in the way ?

In the first place, as is pointed out by the Secretary in his report, tests of new varieties of seed and of manures require a degree of attention and supervision in all stages from the sowing of the crop to the weighing of the produce, which the agriculturist is not accustomed to exercise. Failure at any stage is certain to vitiate, if it does not entirely destroy, the value of the results obtained and it is in fact lack of care at the very end of the test when the results are just about to be obtained that leads to most of the failures that occur in our co-operative experimental work.

The difficulties of supervision are greatly increased by the fact that these tests have to be carried out in duplicate or triplicate on small plots. If they are not duplicated, their value is practically nil. The areas under any one test must be small, because the amount of seed or manure that can be made available is limited. If tests are to be carried out in more than a very few localities, that means that the quantities that can be supplied to any one individual must be small. To harvest, thresh and weigh separately the product of a number of small plots is work which does not appeal to the agriculturist, however intelligent he may be.

Another difficulty which we have to face is the fact that a considerable number of those who are prepared to co-operate in this testing work are men who have a number of interests other than agriculture. They either have their lands leased to tenants or have to entrust the supervision of agricultural operations to writers or to maistries. Under such conditions it is, I believe, too much to expect the carrying out of careful tests and the collection of accurate results.

Under the circumstances we may perhaps congratulate ourselves that so much useful work has been done. There are, as a matter of fact, quite a considerable number of our members upon whom we can depend regularly for valuable results from the co-operative experiments they have undertaken. The results of the present year's work seem to indicate clearly that with greater assistance in the way of technical staff at the time of harvest, we shall be able to obtain a very greatly increased body of valuable results. As the Secretary indicates in his report, the employment by the Union of trained fieldmen for this purpose in the Hassan District has aided very considerably in this direction. I hope that it will be possible during the coming year for the Union to employ fieldmen in larger numbers so that we can place a man during the harvesting and threshing season in every taluk where any large number of tests are being carried out. To what extent the finances of the Union will allow for the expansion of this useful work will have to be considered at this meeting. If as seems probable the Union will not be able to finance the scheme in full, I trust that Government may be able to increase our subvention especially for this purpose. I am firmly convinced that a carefully organized series of tests conducted all over the State will lead to a great saving of time and money in connection with our demonstra-

tion work and will very largely eliminate the danger of failures which, under present conditions, seem at times unavoidable.

My remarks up to the present have, I fear, been of a rather technical nature and I turn to a subject which may be of greater interest to many of those present to-day. I refer to the publications which are being issued under the auspices of the Union.

I have not, in the past, had much faith in the influence of the printed page or in that of the spoken word as a means of inducing our agriculturists to improve their methods. I think, we must admit, that in Mysore as in other parts of the world, speeches and articles in special Journals or the regular public press can be used more effectively in arousing interest in political matters than they can as agricultural propaganda. It is difficult to imagine a speaker, however eloquent, arousing an audience of agriculturists to wild enthusiasm over the virtues of an improved plough or a new variety of sugarcane. Nevertheless, the influence of the printed page as a means of agricultural propaganda can, I believe, no longer be ignored. It has therefore been a matter of great importance to the Union that Government have officially recognized the value of our Journal. The interest evinced by the Revenue Commissioner in introducing the Kannada Journal among village panchayats and that of the Director of Public Instruction in connection with its introduction in middle schools of the State are further evidences that the Journal's influence is increasing in the State. We have to thank these officers for their cordial co-operation.

I believe that the Journal, largely due to the ability and industry of our Secretary, is a decided credit to the Union but I also believe that it could be very greatly improved. I can speak without undue prejudice in this matter, because I think I am safe in saying that much the most regular and extensive contributor to the Journals' pages during the past year has been myself. With few exceptions the other contributors have been members of the staff of the agricultural and associated departments. The response from our non-official members has been disappointing. There are, I feel sure, a very considerable number of agriculturists and others in Mysore who could contribute articles of real value. I may point out that any real or imaginary lack of powers of expression either in English or Kannada need deter no contributor as long as he has matter of importance to

publish. The editorial staff can be trusted to brush up and if necessary to remodel the style of the articles so as to make them both clear and elegant.

We have on our programme for discussion in the next two days three very important questions, the question of the best way of distributing seed of new varieties originated by the Agricultural Department so as to avoid wasted effort, the question of testing agricultural implements and machinery so as to ascertain in the shortest time possible their suitability or otherwise to Mysore conditions, and the question of the distribution of breeding bulls from our newly established Cattle Farm. All of these questions are likely to elicit lively discussion and I feel sure that from that discussion will emerge suggestions and conclusions which will greatly aid the Agricultural Department in its important work.

The development of activities indicated in these subjects must depend very largely upon our securing the co-operation of progressive and intelligent agriculturists. As a matter of fact, a considerable number of the prominent members of this Union are engaged in multiplying new varieties of ragi on their own farms in connection with our scheme of pure seed distribution. The expansion of our activities in this connection must depend almost entirely upon your co-operation. I also anticipate calling upon you for very wide assistance in connection with a thorough scheme of testing improved agricultural implements which, I hope, we shall be able to develop in the near future.

Before closing my remarks, I feel that I should refer to a recent order of Government which seems certain to have a far-reaching effect upon our work in connection with agricultural development. I refer to an order appointing a special Standing Committee consisting of the Revenue Commissioner, the heads of the three Development Departments and the Secretary to Government, Development Departments. This Committee has as its main duty the prevention of wasted effort where the work of these various departments overlap. If this Committee carries out its duties in an efficient manner it will undoubtedly prevent to a considerable extent the waste of time and money that is inevitable where departments with much the same object in view work without reference to each other.

The ideal of our Union should be an intelligent, happy and prosperous agricultural population. This can be attained under the most favourable conditions only through the unselfish and wholehearted co-operation of all agencies, non-official and official, which have any connection with agriculture. In that co-operation, the Mysore Agricultural and Experimental Union should lead the way.

Speech by the Dewan at the Annual Meeting of The Mysore Agricultural and Experimental Union.

Dr. Coleman and Gentlemen,

This is the first occasion on which I have had the pleasure of addressing you, and I am sure you will allow me to say that I am very appreciative of the honour you have done me in inviting me to open your annual conference.

Your Union has much solid achievement to its credit, and it is a real pleasure to me to be associated in any way with such a body. The Department of Agriculture is one of the departments of which we are justly proud, containing as it does some of the most experienced and talented scientists in India, and it is peculiarly fortunate in its Director.

I should be surprised if the Director does not number your Union among the most noteworthy achievements of his Department, for the willing co-operation of independent workers like you is at once a proof of the value of the Department's work in the past, and a guarantee of its progress on right lines in the future.

Your objects, as stated in your constitution and rules, are to foster a feeling of unity, and to further agricultural development in the State. Your motto—which I like even better—"Agriculture is the hope of the nation," gives to your aims a patriotic and ethical *motif* which hallows your activities, and makes them in a true sense service of your country and country-men. I consider the motto to be most appropriate, as agriculture is the industry that must be the foundation of every State – especially a State like ours, in which 72.4 per cent of the population are *directly* dependent on it. I say *directly* because, indirectly, and in a larger sense, all the rest are also dependent on it, for in the last analysis, commerce, manufacture, every form of activity, even in the most industrialized countries of the West,

run back to the bounty of the earth by which every worker, skilled or unskilled, must be fed and by which his wages are ultimately paid.

Mysore will remain essentially an agricultural country for as long as one can foresee. To us the welfare of the agricultural population is the prosperity of the State, and the neglect of anything which could advance agriculture is failure in duty towards the country. That the agricultural policy of the Government has constantly kept this truth in view is evidenced by the steady growth of expenditure on the Agricultural Department, from Rs. 56,500 in 1910 to Rs. 3½ lakhs in 1920 and considerably more than 5 lakhs at the present time. These figures relate to the expenditure on the Agricultural Department proper, and do not include that on the allied departments of the group. Government have gladly given this money as they are confident that it enures directly to the benefit of agriculture - in other words, of the State. Each increase of expenditure has meant the opening of new fields of work and the improvement and expansion of established activities.

We have been giving all we can, our only regret being that we have not more to give, and we know that, under Dr. Coleman, the Department is giving the public full value for every pie of this expenditure ; but that is not to say that it has been possible to do all the work there is to be done. For one thing, a large and important part of the work lies outside the province of purely official action ; and for another, even inside this province, much ground has had to be left uncovered, or but sparsely covered, owing to financial limitations. As Dr. Coleman has pointed out in his address, the Department requires help and support in the testing and demonstration of agricultural implements, seeds, manures and methods. The very object of this Union is that the best of our agriculturists should join forces with the staff of the Department in a common effort to improve the State's agriculture ; and when I look at your membership, I can think of no collection of persons better fitted to undertake and succeed in this most important work. The Director is quite enthusiastic about the work you have already done, and I for my part find in your record an assurance that you will persevere in the service you have undertaken, and demonstrate that it is only the enlightened co-operation of non-officials that can give body and fruition to the research and labours of official experts. I may assure you Govern-

ment are no less proud of the co-operation of practical agriculturists with the Agricultural Department than they are of the work of the Department itself, and they are fully aware that progress to be real must be based upon team-work. It is with the object of securing team-work that the Agricultural Development Board, referred to by Dr. Coleman, has been constituted ; but of all team-work, there can be none more effective at present, nor any more full of hope for the future, than that in which officials and non-officials alike put their strength together and advance shoulder to shoulder towards a common goal. In this, let me hope with Dr. Coleman that your Union will lead the way.

I was particularly glad to learn that your Hassan Branch has good work to its credit. It indicates the scope there is for a more intimate extension of your work in the Districts—and later on, possibly, there might be further ramifications.

I was rather amused to hear Dr. Coleman speak disparagingly of the potency of the printed page and the spoken word—for I happen to know that he can make most potent use of both ; but I agree with him to this extent, that however useful your Journal may be, it can never be so inspiring as your example. In fact, the Journal is, and ought to be, a record of your work and your thought, and the work and thought of others like you. I think that your Journal is doing well, and it is in recognition of its usefulness that Government have readily come forward with their support.

Before I conclude, I wish to make one or two observations which occur to me. Our chief industrial crops are cotton and groundnut. The trade in both these commodities has, I fear, suffered to some extent during this year ; but I hope that better times are in store for it. The Department has evolved superior strains of cotton, which command very good prices. But it is necessary that no adulteration should take place if this cotton is to retain its reputation in the market. The superior varieties of groundnut, too, are exposed to this danger. The consequences of adulteration are deplorable and we should do everything possible to stop our people from pursuing this suicidal course.

One of the chief directions in which progress has to be made is the development of co-operative marketing in regard to these and other commodities. Cardamom growers stand in special need of this

help. It is to be hoped that the Association, which has recently been started to help them, will achieve its purpose.

These and many other problems are, I know, receiving your attention. I hope that every year you meet in conference you may have the satisfaction of recording a substantial advance in the improvement of agriculture in the State.

I do not think I need detain you longer and shall conclude with my cordial good wishes for the success of this meeting.

The Cultivation of Pepper in the Mysore Malnad.

BY

A. K. Yegnanarayana Iyer, M.A., Dip. in Agri. (Cantab.), N.D.D.,

Deputy Director of Agriculture in Mysore.

(*Continued from page 19.*)

PART II.

The selection of the cuttings from vines selected for their heavy bearing qualities raises the question of varieties and of what individuals to select from therein for propagation. As regards varieties quite a large number of named varieties exist, though accurate studies as to their definite and distinguishing characteristics do not appear to have been pursued satisfactorily anywhere. Although characters of economic importance and sufficiently sharp to distinguish certain varieties stamping them as different from one another do exist, still it is not unlikely that many of them are different only in name, being called by different names in different localities. On the Government Farm at Marthur as early as the year 1917, a collection of named varieties of pepper was got together for trial, and this has been added to especially in respect of the Malabar varieties during 1920, 1922, 1923 and 1928, as already mentioned in another connection. Furthermore during the last three years a performance record has also been kept of the different vines, whether of the same or of different varieties and the result of the work may be taken as the basis for the following remarks.

The varieties got together and planted are the following :—

A. *Mysore varieties.* 1. Malligesara Bile,

2. Do. Kari,

3. Okkala Raju,
4. Dadakan Balli,
5. Kesarukaluballi,
6. Konanakadige,
7. Thatti Kai,
8. Hiresara,
9. Nelagorai Balli.

B. *Malabar varieties.* 1. Kalluvalli,
2. Balamcottah,
3. Cheriakodi,
4. Uttarankota.

C. *Un-named varieties* from Travancore.

D. *Wynad varieties.* 1. Balamcottah,
2. Cheriakodi.

As however the study of the pepper is by no means the main work of the Farm, which has mainly related to the work on the *Koleroga* disease of the areca, only that aspect of the study of immediate and practical interest has been attended to, and only this is therefore dealt with here reserving to a future occasion a description of the characteristics of the varieties. Nevertheless a tentative and rough account of the characteristics of at least some of the varieties grown locally as are known to and understood by areca gardeners is given here so that it may afford some basis for a future accurate study. This description is furnished by Mr. Tenginkere Subramanya Bhattar, a keen and intelligent observer of great experience as an areca gardener to whom my thanks are due.

Wokkalumarata.—Large berries, heavy and pungent and well filled berry. The pepper with the highest quality. If white pepper is made, pepper is like pearls ; generally fetches Rs. 2 per maund more than any of the other varieties. It is only a small to moderate bearer, may be only 50% of the others, spikes are short about $2\frac{1}{2}$ to 3 inches and only few berries in spike, about 20. Ripe berries are red, but sheds much even when yellow ; leaf longish and light.

Malligesara.—Leaf dark green. Spikes $3\frac{1}{2}''$ to $4''$. Well-filled spikes, berries small. Fruits red. Does not shed ; good yielder.

Thattisara.—Leaf thin longish and dark green. Spikes $4''$ to $5''$. Fruit red. Spikes themselves shed when berries ripen—good yielder—well-filled spikes, slightly larger berries than Malligesara.

Karimorata.—Small spikes curved slightly—only 2″ to 2½″ close filled spikes and slightly large berries, fruit red. Does not shed, berries dark green, moderate yielder,—but yields uniformly every year.

Arasina Morata.—Short spikes like above. Ripe berries yellow. Other points like above.

Kalluvalli.—Longish leaves, long spikes, not well filled, ripe berries red, sheds leaves much, only spikes shed, not berries.

Balamcottah.—Slightly shorter spikes than above. Broad leaves. Ripe berries red. Well-filled spikes, slightly smaller berries than Kalluvalli.

Doddaga.—Spikes about 3″ curved; leaves slightly roundish—large berries; ripe berries red.

Coming now to the varieties grown on the Farm: of direct practical value are the facts, firstly, the Malabar varieties Kalluvalli and Balamcottah have been found hardiest; while a large number of these have survived and continue to bear, all the other varieties have very nearly disappeared, only a few here and there survive, and some are either quite gone or are represented by solitary bushes: secondly, these two Malabar varieties also lead in respect of yield, giving both a high average per vine over a large number but also with individual vines of outstanding merit. Thus in the year 1927-28 a yield of 372 lbs. of green pepper was harvested out of 170 vines giving an average of about 2 lbs. per vine. Individual variations among these were as follows:—

Class lbs.	No. vines.	Class lbs.	No. vines.
0–½	21	3–3½	13
½–1	22	3½–4	0
1–1½	40	4–4½	5
1½–2	11	4½–5	0
2–2½	37	Above 5	20
2½–3	4		

Among the last class, *i.e.*, yielding over 5 lbs. per vine, were vines which may be classed Elite which gave 7 lbs., 8 lbs., 9 lbs., 12 lbs. and 14 lbs. Somewhat similar variations have occurred in the other years also. It is obvious that as parent plants to select cuttings from for

Pepper, "Balamcottah" variety, showing both well-filled and poor spikes.

Pepper, "Kalluvalli" variety, showing both well-filled and poor spikes.

propagation these Elite are incomparably better than the rest of the vines. As a matter of fact a good portion of the planting material at present is being taken out of these bushes. It may be of interest to note that these parent plants have continued to maintain their superiority in yields over the other vines continuously for some years, as the following table will show :—

Yields of green pepper in lbs. and ozs.

Parent vine	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29
B. 68 / 15	0-14	4-15	5-0	9-0	12-0	8-0
B. 51 / 27	3-0	3-8	3-0	6-0	14-0	10-0
B. 63 / 83	..	2-0	2-7	4-0	8-0	8-0
K. 61 / 63	4-10	11-12	8-6	12-0	9-0	2-0
K. 79 / 33	..	..	..	5-0	8-0	5-0
K. 72 / 65	..	..	..	4-0	7-0	3-0

No attempt has been made to analyse the causes for the differences in yield, whether the high yields are due to the nature of the spike clusters or of their number on the bush, for variation in this character of the spike is a very conspicuous feature. Due to a large number of male flowers or of improperly fertilized female or hermaphrodite flowers on the cluster (or spike), they are seldom completely filled with berries from stem to tip, but show patches more or less bare of berries along their length. The accompanying photograph of a few clusters is illustrative of this fact. A spike with no blank, of one of the good varieties, say Balamcotta, is generally about 4″ to 4½″ long and will contain about 70 to 100 berries,—other clusters may not contain even half of this number, while others may be still poorer. It is obvious that a moderately grown vine with well and fully filled

clusters though few may be preferable to a big leafy vine with a large number of poor clusters scattered all over. Work calculated to find out or evolve a variety or strain in which this character of bare patches in the clusters does not occur at all, will be productive of great good and will have to be one of the main objects of breeding work if ever established.

There is certainly much difference in this important character of the quality of the spike between one variety and another, sufficient to afford a good starting point for such work of improvement. Before leaving this subject reference may be made to propagation from seed. Such a method has the obvious drawback that the resulting plants may not be true to the parent, but although such is bound to be the case in a plant like pepper where cross fertilization is so patently general, nevertheless it is not known to what extent deviations from the parent may occur nor is it definitely known how long it will take for seed grown plants to come into bearing, as compared with plants raised from cuttings. The risk in any case, especially in the case of a perennial plant like pepper, is so great, that the method cannot be thought of for purposes of ordinary propagation. In view, however, of the possibility of obtaining special good varieties, the method has its value, and accordingly a small beginning was made in the last season on the Marthur Farm to raise such seedlings. Germination has been very meagre and only very few seedlings have come up. It is however proposed to sow a larger number of seeds and under better conditions, in the hope that a good number of plants may be available for putting out for observation.

Once the cuttings planted have taken root, the growth of the pepper is fairly rapid. In the first year of growth a good vigorous vine will attain a height of four feet and about a similar rate of growth may be expected in the following years. To enable the vine to hug the standard securely it is necessary to tie it round to the standard at different heights as it grows: this is a part of the regular routine of cultivation in a pepper garden. A good stock of tying material is kept handy for this purpose, an ample supply of which in the areca *cum* pepper garden is afforded by the broad leaf bases of the areca fronds which are collected as they drop and stored. Stripped of the outer rough side, the inner surface forms a pliable tough sheet and torn into long and narrow strips, it forms excellent tying material.

Pepper as grown in arecanut gardens trained on the arecanut trees.

Pure pepper plantation, vines trained on large jungle trees.

These are put on at intervals of a foot or so and renewed periodically generally once a year, as they perish and cease to support the vine. Both vines, those grown in arecanut gardens and those in pure pepper plantations, receive the usual annual cultivation in the shape of digging or hoeing, manuring, and occasionally of irrigation in hot weather where possible. In the areca gardens the annual cultivation and manuring is rather elaborate and the pepper vines as a matter of course share the advantage. It is usually on a three years' rotation that gardens are dug and a heavy application of green leaf mulch of a good depth of even three feet is given. Manuring is however given in two years out of three in any case and often every year. Clean cultivation to keep down weeds and adequate manuring every year are however both essential. Shortcomings in this respect are dearly paid for. From about the end of October the digging can be started, but it is often delayed somewhat till the areca harvest is over and continued till about the commencement of the earliest rains of April.

The manure used in the *malnad* for pepper or areca is only ordinary cattle manure, but the peculiar method of making manure in this tract results in manure of a very good quality. Throughout the monsoon months cattle are bedded in their stalls every night over a thick layer of green leaves brought from the jungle, which becomes well mixed with the excreta, both solid and liquid, and trampled upon. Once in a few days the manure is hauled out to the manure pits and the process is repeated till the cessation of the rains after which the manure pits have to be cleared. Even in the hot weather, bedding for cattle is general, dry grass from the jungle being cut and stored for this purpose. Of this manure, the usual quantity applied to each areca tree (together with its companion vine) is about 30 lbs., but growers would gladly increase it if only they could. This may however be considered an irreducible minimum dose for the welfare of the garden. In Malabar and elsewhere fish manure is also applied with advantage, at about $\frac{1}{2}$ lb. per vine.

No results of regular manurial trials of a fundamental character are available, and this kind of information is a great and urgent need in regard to the manuring of the pepper vine. Manurial experiments of a kind have been reported from the Taliparamba Farm of the Madras Department of Agriculture from which the following information is compiled :—

Treatment	Yield in Madras measures of green pepper per vine for the 9-year period from 1907 to 1915.
Leaf mould dug	4.91
Do. lime	4.32
Oil-cake	5.22
Cattle manure	6.06
Ashes	4.57
Fish manure	6.38
Leaf mulch	8.76

If we may draw conclusion from these, it is certainly an astonishing fact that a mere covering of the surface with leaf, should have resulted in the highest yield of all. The next highest yields are given by fish manure followed closely by cattle manure, both of which are valuable indications. Oil-cake comes next, and last of all more or less in one class come ashes, leaf mould, and leaf mould *plus* lime. The lime far from having any beneficial effect has really acted in quite the opposite way, this treatment giving the lowest yield of all.

The pepper vine begins to bear in the fourth year after planting and continues to do so for a period of several years which is variously put down from 12 to 20 years. The lower limit is probably a safer guide so far as the profitable bearing power of the vines is concerned, the best period being considered to be from the 7th to the 10th year, after which the yield falls off. Whether the ageing and the consequent gradual falling off in the yield can be avoided to any great extent by the process known as lowering the vine in the case of the betel-leaf vine, can be adopted in the case of the pepper, a closely related plant, is worthy of consideration and experiment. This process is a peculiar practice usual in our State, and by this means the betel vine is kept young or renovated yearly, so that it lasts for generations ; it consists of carefully lowering the vine from its support and burying a length of six feet or so of the bottom portion of the vine coiled up around the base of the standard. The pepper vine will probably respond to this treatment favourably, in addition to being kept under manageable proportion as regards height. The height to which a vine will climb and grow if left unchecked is really a troublesome feature from the point of view of harvesting. Vines can be seen reaching a height of 25 and even 30 feet though any height

more than 15 or 16 feet makes harvesting difficult. In practice they are kept down by a certain amount of top pruning at every harvest and in the case of the so-called wild pepper the vines are pulled down where they cannot be easily reached.

The pepper plant in our *malnad* begins to throw out flowering spikes soon after the early rains of April ; a heavy rain at this time following upon a continuous dry spell, is said to be favourable for a good and uniform flush. The flowers themselves open only during June and July and berries ripen and are ready to pick about the first week of February. Picking is commenced as soon as the berries are seen turning yellow here and there. Stout bamboos with their side branches at each node trimmed off suitably are used as ladder by the pickers. The daily harvest is piled up and kept over night, and then the berries are freed from the cluster by spreading them all over a mat or clean floor and trampling the berries out. After the berries are thus separated out, they are ready for drying. They are put out to dry in the sun either immediately or sometimes after a preliminary plunging of the berries in boiling water. In the former case the berries take six or seven days of good bright sun to dry it completely ; in the latter case as the skins slightly rupture on account of the immersion in the boiling water, the drying is effected much sooner. The pepper is also dried in the cluster and the separation of the berries carried out after the drying—a method in which the berries separate much more easily. Both processes yield, however, one and the same class of pepper, *viz.*, the black or ordinary pepper of commerce in which the skin dries black and shrinks over the hard inner coat. The outturn of dried black pepper is usually about 25 % on the weight of the green pepper in cluster as harvested.

Sometimes the special quality called white pepper is also made. For this purpose, the fully ripe clusters are kept piled up after harvest one or two days until the whole becomes dead-ripe turning completely yellow and orange. The berries are then freed from the cluster by trampling and are put into water where they are kept to soak for several days until the outer skin with the pulp can be rubbed and washed off. After this cleaning, the pepper corns are dried in the sun and when fully dry become ready for market as white pepper. White pepper, though it looks more attractive than the black, is devoid of the peculiar flavour of the pepper which is due to the aromatic oil

contained only on the outer seed coat. It retains, however, fully, the acrid or pungent properties of the pepper. The price fetched by white pepper is also much higher, generally 50% more than that of black pepper. Quality in pepper is judged firstly by the centres of production long recognized by the trade, such as Malabar, Cochin, Aicheen (Dutch East Indies); such classification does in all probability correspond to real and measurable characters in the pepper. Inside of such classes quality is generally fixed primarily by the weight per unit measure, apart from the obvious defects like mixtures, unevenness, etc.; admixture with immature and ill-developed pepper corns is the commonest defect, a result due to unfavourable season. A Mysore seer of good pepper will generally weigh from $1\frac{1}{2}$ lbs. to $1\frac{3}{4}$ lbs.

The yield per acre of pepper may be calculated taking an average of about 1 pound of cured pepper per bush. In the ordinary areca plantation where the pepper receives no special attention this rate is not always reached and seldom exceeded except with specially good plants. Trained on large trees with plenty of room and sunshine, yields may go up to 4 lbs. of pepper per vine; on one estate the best bushes reached as high a figure as 7 lbs. per bush. In well-cared-for pepper plantations with pepper grown as the sole crop, a yield of 3 to $3\frac{1}{2}$ lbs. of cured pepper is said to be general in Malaya, a figure which is also reached sometimes in the areca gardens of the Konkan. The yield per acre naturally varies with the condition under which it is grown, whether by itself as a pure crop or as subordinate to areca or coffee, not to mention other factors like distance of planting, variety and so on. Pure plantations are certainly the most satisfactory from the point of view of yields, and even in other respects, the combination of the pepper with areca or coffee is not always liked by planters owing to the interference with the cultivation and other work required for the main crop, although such mixed cropping is the more general practice in our *malnad*.

The pests and diseases to which pepper is subject are singularly few in number. A disease which broke out at one time and spread to an alarming extent and which even now exists here and there is the pepper wilt. About twenty years ago the disease appears to have broken out almost like an epidemic in the Wynad pepper plantation and caused the death of thousands of vines. Even in Mysore, on the

plantations, the disease is spoken of as having wrought similar damage and led to the neglect of pepper planting as a remunerative industry especially in the light of the better prospects with new crops, like rubber and tea and of established crops like coffee.

The pepper wilt disease, as its name implies, is characterized in so far as its outer symptoms on the vine are concerned, by a gradual drying up of the vines, the leaves first losing their rigidity and drooping and exposing the stems, the clinging roots losing their grip and the vines therefore falling away from the standard, then the leaves yellowing and shedding and later the complete withering of the vine. Dr. Butler who first studied the disease came to the conclusion that the disease was due to a fungus of the species Nectria, which gaining entrance through the roots, invaded the tissues, ramified in the vascular bundles choking them completely and thereby preventing the ascent of water into the tissues and causing, therefore, the drying up of the vine. He also established that it was the same fungus as caused wilt in Togari and also similar to the wilt in cotton and allied plants.

It may be noted that the damage by pepper wilt is not so much noticed in the pepper grown in the areca gardens as on the upland plantations owing probably to the abundance of moisture in the former ; a fact also referred to by Dr. Butler that under such conditions the disease makes only slow progress even when the infection is present.

The roots of the pepper vine are also subject to damage by eel-worm attack which brings about a drying up similar to that by wilt disease. As a matter of fact, the wilt disease was considered at one time to be due solely to the eel-worm attack. Studies with a view to the devising of remedies were conducted by Dr. Butler who concluded that the solution lay only in the growing of resistant varieties beyond which matters have not progressed. Fortunately, however, the disease does not appear so severe or widespread at the present time as to cause any anxiety or alarm.

An insect pest of some importance, which prevents the development of the berries, and which is ascribed to the havoc of a flea beetle is reported as prevalent in Malabar where the disease goes by the name of Pollu. Yields are said to be considerably reduced as a consequence in certain years when the pest is severe. It has not been heard of in Mysore and in any case, even elsewhere, its damage is not by any means

serious. A small scale insect identified as Aspidiotus (sp ?) has also been noticed on the green berries, but this also is of very insignificant moment as a pest. On the whole then the pepper should be considered as far as diseases and pests are concerned as a much safer crop than many of the *malnad* or *maidan* crops.

To sum up : there is great scope in the *malnad* for the extension of the area under pepper, firstly, in the areca gardens themselves and secondly, as pure pepper plantations inthe extensive *Kans* or jungles. Even in the existing coffee estates, pepper planting as a subsidiary crop deserves great attention. The cultivation of the pepper as a subsidiary crop in areca or coffee involves very little of additional expense or attention, while in pure pepper plantations the expenses of cultivation are comparatively moderate : in respect of money return at present prices, it takes a high rank possessing at the same time a large measure of freedom from pests and diseases. The planting of well-tried and high-yielding varieties is a most important point to attend to as it is likely to result in very much larger yields than otherwise.

The Mysore Agricultural School.

Distribution of Diplomas and Prizes.

The Annual Function of the Distributing Diplomas and Prizes to the graduates of the Mysore Agricultural School was held on the 5th July 1930 in the Mathematics Hall, Central College, under the presidentship of Rajamantrapravina Mr. C. S. Balasundaram Iyer, B.A., Member of Council.

We publish below the Vice-Principal's report and summaries of speeches made by the Chairman and Dr. Leslie C. Coleman.

Report by the Vice-Principal.

The number of applications for admission to the School has been steadily increasing, while the accommodation and facilities at the School have been almost stationary. The result is that a good many students have to be denied admission. An entrance examination is held to help the Director in selecting students for admission. In addition to this, the students are interviewed by the Director and this helps us, to some extent, to eliminate those who would join this School without any definite idea of what they

are going to do after completing their studies here. As far as possible, the best qualified students are admitted, consideration being given to communal claims, and in this the Director is assisted by 2 non-official gentlemen. With the limited accommodation there is, it happens that some boys who desire to undergo training in Agriculture for the purpose of farming on their own account, and who are not particular about securing the diploma, fail to get seats. So far, we have insisted that all students must be residents in the Hostel as we have found it necessary that the students must be available whenever there is any work on the Farm, which is likely to be of interest to them.

The following figures bear out what I have stated above in general terms :—

The number of applicants who sat for the Entrance Examination was 96 in 1929–30 and 102 during the current year. Of these, only 28 and 26 could be admitted during the past and present years owing to limitations of accommodation and facilities. The total number of students in the School was 60 last year against 65 this year.

Last year all the 9 students in the Final Year Class passed, 7 securing the diploma and the remaining 2 being declared eligible only for certificates. This year 5 students in a class of 9 have secured the diploma.

A new block of rooms is being completed and will be available for occupation by about the end of this month. Another block has just been sanctioned and we may expect it to be ready in about 6 months' time. When that is ready for occupation, we shall have sufficient accommodation for the students we now have in the School. As it is, we are taking in as many students as we can possibly accommodate in the School rooms, irrespective of hostel accommodation, and until larger rooms and more hostel accommodation are made available, no larger number of students can be taken.

In past years, we suffered from a lack of facilities for a proper amount of practical work to the students. This year, however, we have had additional facilities given to us for this kind of work, and we hope to be able to give the students this year, a little more of field work than we have been doing all these years.

The number of scholarships available have remained practically constant. Government give three merit scholarships of Rs. 15 each

and 24 ordinary scholarships of Rs. 10 each. In addition to these, scholarships are given by various District Boards as follows :—

Shimoga District Board	..	..	2
Tumkur District Board	..	..	2
Chickmagalur District Board	..	..	1
Kolar District Board ..	..	..	2

The Tumkur District Board has recently increased the value of the scholarships from Rs. 10 to Rs. 15 a month.

The activities of the students in the realm of sports and physical culture have been maintained at a level permitted by the money available for this purpose. Cricket has as usual taken the first place among out-door games, a secondary place being occupied by football, hockey, volley ball and tennis. Expansion of activities in this field is mainly dependent on the money at our disposal. With the increase in the number of students in the school, the need for a properly equipped club or reading room is actually felt and the provision of this and proper accommodation for the Physical Culture Club, are matters of serious consideration. One block of buildings to meet all these needs, if put up in a suitable position, would provide all the amenities that students of an institution of this kind, isolated from the City, should possess.

A word might be said about the future of the students passing out of this Institution. The establishment of the Bhadra Colony has given some of the passed students, the opportunity they were looking for, for starting farming. If indications are noticed that the Colonists are likely to make a success of their undertaking, it is hoped that Government will promote colonies in other localities without waiting to see actual results, as this may take some years. Even then, the colonies can offer work for only a very few, leaving a good many who also would like to farm but have no facilities for it. There is room for encouraging these young men in a smaller way, to take up farming as their profession. There are many places in the State where good Government land is available for cultivation. What usually happens is that when applications are made to Government for land, these are advertised, other applications for the same land are invited, and the land is sold in auction for the highest bidder. It is common knowledge that under such conditions the land usually

passes into the hands of speculators. Thus the man who really wishes to undertake farming and goes to the trouble of finding out a suitable bit of land for his purpose, rarely has a chance of obtaining that land. If therefore Government would come to the rescue of these men who have passed out of the Agricultural School, give them the land of their choice at some upset price, and the help that they are entitled to under the existing Revenue and Co-operative Regulations, we are sure to have more of them taking to agriculture and utilizing the knowledge they have obtained in the School. If we can succeed in inducing them to settle down on land, either singly or in groups, in different places in the State, we shall have centres from which we can expect the spread of a knowledge of improved methods of agriculture. Incidentally, we shall also have centres from where the work of Rural Betterment and Rural Development can more easily be undertaken.

To the graduates of this School, I have only this to say that we look to them to do their very best in demonstrating that their highest aim is to improve the conditions in rural parts both agriculturally and culturally. They must be living examples of plain living and high thinking and must endeavour to show more by example than by precept that the motto of the Mysore Agricultural and Experimental Union is something which can be lived up to.

Mr. C. S. Balasundaram Iyer's Remarks.

The Chairman congratulated the graduates on their success. He realized their difficulties and hoped that they would make a success of their lives. He sympathized with the suggestion of the Vice-Principal and said that some way should be found whereby they should be settled on land and helped to put the theory they had learned into practice and to serve as examples. He also realized the difficulties in the school and hostel and hoped that it would be possible to increase the facilities and to provide more hostel accommodation. Schools such as this served a very useful purpose and deserved every encouragement. In any scheme of technological instruction Agriculture ought to have an important place. Getting young men to take to farming, is full of possibilities. The public have not recognized that brains should be put into agriculture. The fact, however, is that the larger the amount of brains put into it the greater will be the country's prosperity.

The young men who have passed out would, he hoped, play their part and trusted they would have every occasion to be proud of their school and of their learning. When they become older, they would be looked up to as men of light and leading by younger men. There was a tendency to think that this kind of education was not worth while, but that was not a correct estimate of education. The man who practised agriculture in a better and scientific way, did a great deal of good and could compare himself favourably with any B.A., or M.A. They (students) were doing very much better service to the motherland. They might well congratulate themselves on the wisdom of their choice. He wished all a very prosperous future career.

Dr. Leslie C. Coleman's Remarks.

"The last few years have shown in Mysore a steadily increasing interest in agricultural education. As a result the classes in our Hebbal School have been growing so that now the number of applications for admission to the school considerably exceeds our accommodation. Educated young men are now seeking many avenues for occupation outside Government service and it seems certain that as time goes on a continually increasing number of young men will have to turn to agriculture for a living.

As we are aware Mysore is in many ways handicapped from the standpoint of industrial development and it appears unlikely that within the next few years at least there will be any large reduction in the proportion of our population which have to make their living from the land. With the spread of education more and more educated young men will therefore be forced back to agriculture.

If our main industry is to develop as it should, we must make the best possible use of this material. It is obvious that the Agricultural Department with its comparatively small district staff can introduce rapidly the improvements which it recommends only if we can obtain the co-operation of intelligent agriculturists all over the State. We must therefore look upon the increased interest evinced in agricultural education as a very encouraging sign.

Turning to the graduates, allow me to say something from an experience which has not been confined to scientific investigation and book learning. May I remind you that unlike the most of you I was compelled when I was still very young to obtain that practical

acquaintance with agriculture which you have had to obtain in a rather concentrated and imperfect manner during your school course. I trust that your three years' training has impressed upon you the necessity of being able to work skilfully with your hands if you are to make a success of farming. Without this knowledge and skill you will be at the mercy of your hired workmen.

The present is a time of great difficulty for agriculturists all over the world. Prices of agricultural produce in general have come down to a very low level and it will probably take some years to bring about an adjustment of prices of agricultural produce to those of manufactured goods. If you take up farming it may therefore require several years of strenuous effort for you to establish yourself on solid ground. You will also require self-confidence and stiffness of backbone. All I ask you is—make a decent use of the training you have got, do not waste it. As time goes on your knowledge and experience should fit you to become leaders in the various communities where you will live. If you have to start farming through the purchase of land I would strongly advise you to seek the advice of senior officers of the Agricultural Department before investing your money. It is not an uncommon thing in this as in other countries, to see a man sink his capital in land from which it is impossible for him to make a decent living. You should keep in close contact with the Agricultural Department and I believe you will find its officers only too glad to help you in any way which is in their power.

It is, I think, generally recognized that the physical conditions under which instruction has been and is being given at Hebbal is not of the best but with the comparatively small amount of money that has been available we have perforce had to devote it largely to the employment of teachers rather than to the erection of buildings. I have always felt that in any organization for public service men are more important than buildings and obtaining that is the principle which we have had to follow.

With the increased demand for agricultural education it will, I believe, become necessary to increase considerably expenditure on buildings and equipment. The organization of an agricultural college may be one of the steps which we may have to take in the not distant future. However I wish you to feel that whatever happens in the

future the training you have received is a sound and good one. Were that not the case it would have been impossible to build up an efficient district staff such as we have at present. I would like to remind you that the reputation of the Agricultural Department for efficient service in this State is very largely based upon the work of men who have been trained in the Hebbal Agricultural School. I wish the new graduates the greater success in their careers as agriculturists and wish again to impress upon them the necessity of utilizing their training for the greatest benefit possible of themselves and their country.

On behalf of all those present here and on behalf of the Agricultural Department I thank you, Sir, for having found time to come here and preside over this meeting."

REVIEWS.

Multiplication of Selected Coffee Trees in the College of Agriculture by Grafting.

By Tarsilo Romero.

The above article in the *Phillipine Agriculturist* for June 1930 is very interesting especially in view of the fact that grafting is one of the main items of work undertaken in the Coffee Experimental Station, Balehonnur.

The writer states that grafting has never been practised by the Filipino growers as a method of multiplying desirable coffee trees. It is equally true of the coffee growers of South India. The writer rightly explains that grafting has not been appreciated because it is quite easy to produce seedlings by seeds and also because the merits of grafting and the process of grafting are not known to all in addition to the fact that grafting requires some skill and experience.

The objects of propagating coffee by means of grafting are stated to be two : (*a*) to perpetuate individual characters of trees, and (*b*) to increase the rate of multiplication.

In Mysore we have the third object of producing trees resistant to diseases.

Two methods of grafting—cleft and bark grafting—with different kinds of scions and materials for covering the new grafts have been considered in the articles under review.

The writer has used for scions varieties Robusta, Excelsa, Liberica and Arabica. The scions have been taken from the highest yielding tree to secure a constant supply of fresh scions and selected trees were slightly pruned so as to force the production of water-sprouts (suckers).

Seedlings of Coffea quillou and Coffea excelsa about three years old were used as stock. Seedlings were cleft and bark grafted monthly. Both lateral branches and vertical growths of suckers were used as scions. Too much evaporation of moisture from the new grafts was prevented by covering them with either sphagnum moss, glass tubes or banana leaf petioles. (Fig. 1.)

The grafting tape used was made of white cotton cloth rolled on a stick to a diameter of about 2.5 c.m. and dipped in a mixture containing by weight, one part tallow, two parts resin and four parts beeswax. The tools used were a sharp knife and a pair of sharp pruning shears.

The seedlings used were in nursery rows of 20 c.m. apart. Some seedlings were grown in earthen pots and some in bamboo tubes. The seedlings were in the direct sunlight in the morning and at noon shaded by a trellis partially covered with palm leaves. The seedlings were cut less than 30 c.m. from the ground and then cleft and bark-grafted. Stocks in which grafts failed to grow were grafted again after removing the old cut. Sometimes one or two repetitions were necessary before success was obtained.

Cleft Grafting.

In cleft grafting the scion was cut wedge-shaped: the length of the cut varied from 2.5 to 3.5 c.m. The length of the scion with all leaves removed, varied from 7 to 12 c.m. With a pair of pruning shears a stock was cut at right angles to its axis about 30 c.m. from the ground. Later, the cut was made smooth with a sharp knife. With the sharp blade of the knife the cut was opened downward about the length of the wedge, and then the prepared scion was inserted, placing it very carefully so that the two cambium layers, that of the stock and that of the scion, came into contact. In cases where the stock was much larger than the scion one of the outer edges of the scion was made thicker in order to insure better contact of its cambium layer with the cambium layer of the stock. The wound was tied with twine and then wrapped with the grafting tape. Wrapping was started at the lower end, winding upward until the whole wound was perfectly covered. At the upper end of the wrapping, it was found necessary to press the tape gently against the stem to prevent the entrance of water or the evaporation of moisture from the scion. The glass tube was supported by a stick so that the terminal bud of the scion would not come in contact with it. When a banana leaf petiole was used, a round stick about the same size as the scion was thrust through the centre of a guide hole for the scion to pass through. When sphagnum moss was used a piece of manila paper was wrapped around the stem in the form of a funnel just below the wound. The wet sphagnum moss was placed inside the paper funnel. All covering materials were removed about three weeks after the date of insertion. All the suckers arising from the stock were removed. (Fig. 4.)

Bark Grafting.

The stocks were cut in the same way as in cleft grafting. The length of the scion varied from 7 to 12 c.m. depending upon the kinds used. When a vertical growth or sucker was used the scion was cut much longer because the nodes were far from each other. The scion used always had

Fig. 1.—Different kinds of protecting material.
(a) Banana leaf petiole ; (b-c) glass tubes ;
(d) Paper funnel with sphagnum moss.

Fig. 2.—Effect of lateral branch as scions.
(A) Lateral branch with terminal bud ;
(B) Lateral branch with terminal bud cut off.

Fig. 3.—Effect of the main stems or vertical growths as scions.
(A) and (B) with terminal buds ;
(C) with terminal bud removed.

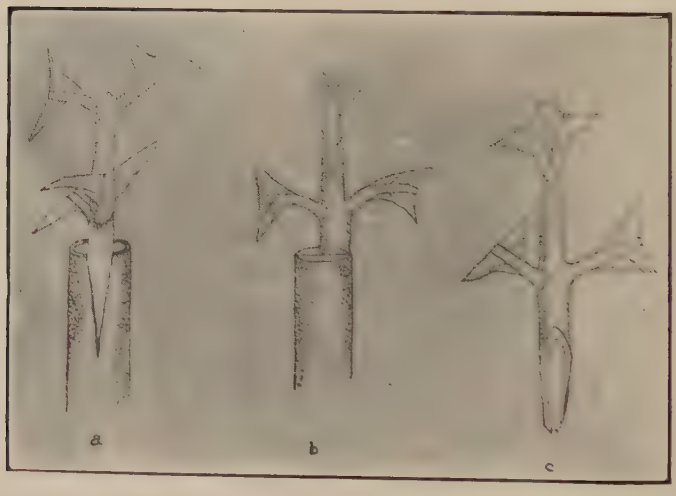

Fig. 4.—Cleft grafting. (a) front view ; (b) side view ; (c) scion.

at least two internodes. With a sharp knife a slit was made at the centre of the cut surface of the stock running downward. The length of the slit depended upon the diagonal cut of the scion. The scion was prepared by removing all the leaves and about 4 c.m. from the lower end of the scion a diagonal cut was made from the upper to the lower end.

The cut was made in one direction only in order to avoid mutilating tissues. Then the prepared scion was inserted between the wood and the bark, placing the diagonal cut surface against the wood. To insure better contact between the two cambium layers, the diagonal cut was not all inserted. To keep the scion in its position it was tied with twine, then the wound was covered with grafting tape as usual. In all cases either glass tubes, sphagnum moss or banana leaf petioles were used for covering. When sphagnum moss was used a piece of manila paper was wrapped around the stem just below the cut surface placing the wet sphagnum moss inside the bag thus made around the scion.

About 1,600 Excelsa, Robusta, Liberica and Arabica scions were grafted on Quillou stock. About 700 scions of the same varieties were grafted on Excelsa stock. Two kinds of scions were used : (1) lateral branches with a terminal bud, and (2) vertical growths of suckers with and without a terminal bud.

The effect of a lateral branch used as a scion is shown in Fig. 2*a*. This plant is not expected to become a normal plant inasmuch as the growth is mostly in only one direction and no branches are produced from the main stem. On the other hand, the effect of a lateral branch with a terminal bud cut is shown in Fig. 2*b*. This plant is not expected to become a large sized plant, because the branches produced are all lateral and do not grow upward. They are all practically in a horizontal position. The effect of vertical growth or of a main stem with a terminal bud is shown in Fig. 3. These plants are expected to become normal plants, because the terminal bud continues its growth upward at the same time producing lateral branches.

Two of sets grafting (1) with, (2) without, cover were carried each month. The percentage of successes varied from month to month and also according to treatment given to the new grafts. The highest percentage of success was obtained during the months of June, February and March. Better success was obtained with cleft grafting than with bark grafting both with and without cover. When Excelsa was used as stock the highest percentage of success was obtained in September and November. Robusta grafts on Quillou gave best results in July, both cleft and bark graftings giving satisfactory results.

Liberica on Quillou gave best results in May and Liberica on Excelsa in September. In both cases cleft and bark graftings were equally successful.

Arabica on Quillou gave fairly satisfactory results in September and Arabica on Excelsa in May with banana leaf petioles as covers. The writer has not attempted to ascertain the reason why grafting has been successful in particular months. Rainfall, humidity, etc., may perhaps give a clue.

For protection from the loss of moisture sphagnum moss and banana leaf petioles proved best during the dry season. In order that the sphagnum moss might not get dry watering once in a while was necessary. When this was done the scions were better kept before the union of the cambiums took place. When using banana leaf petioles it was found necessary to change them once before union took place. If not changed the petioles shrank pressing the scion and causing the death of the graft. Glass tubes proved to be a very efficient cover during the rainy season. To preserve the scions well it was necessary to shade them partially, otherwise the terminal bud of the scion became scorched on sunny days. The newly inserted scions were very delicate, so that with glass tubes as protecting material, the grafted plants had to be well shaded.

Summary of Conclusions.

1. Among the protecting materials used glass tubes proved to be efficient for the rainy season and banana leaf petioles and sphagnum moss for the dry season. In general covered grafts gave a higher percentage of success than the uncovered.

2. The main stems or vertical growth of suckers, with and without terminal buds, were found desirable sources of scions for grafting coffee.

3. Lateral branches without a terminal bud used as scions for grafting coffee produced plants with spreading habits; with terminal buds the growth was practically all in one direction and the plant did not produce branches from the main stem.

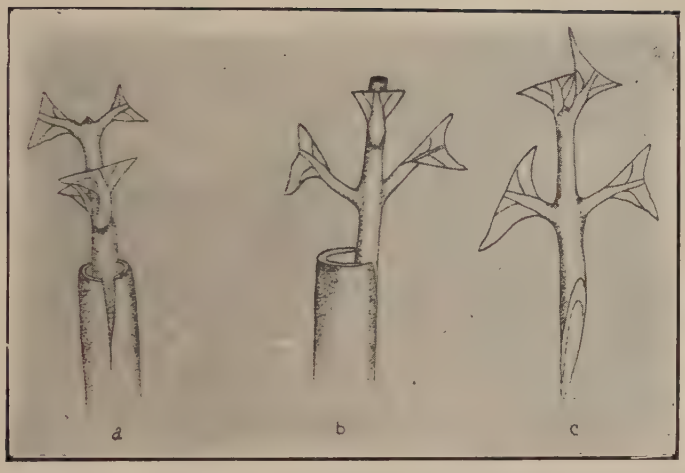

Fig. 5.—Bark grafting. (a) front view; (b) side view; (c) scion.

THE CACTUS INSECT.

1. Young soon after hatching. 2a. Adult female with covering of cottony wool. 2b. Adult female with covering removed. 3. Male. 4. Cocoon from which male emerged.

Portions of cactus leaf showing cocoons of males in clusters. 'Leaves' containing only these and no females are not good for infecting purposes.

SELECTIONS.

Control of Cactus in Mysore by means of Insects.

By K. Kunhikannan, M.A., Ph.D., *Entomologist.*

In the issue of the Calendar* for the year 1928 an account of two methods of controlling cactus in the State was given; one with the help of an insect and the other by chemical means. During the two years that have elapsed since the publication of the article observations and tests have been made to determine the relative merits of the two methods and conclusion has been reached that the insect method is by far the cheaper method of the two and that the use of chemicals can be recommended only for municipal corporations and village panchayets who desire speedy removal of cactus and can afford to spend at the rate of about Rs. 40 per acre. The introduction and spread of the insect would be the better method where cactus is widespread over large tracts as forests, *gomal* lands, etc., and appropriates to itself the moisture in the soil that otherwise would have been available for more useful plants, chokes seedlings of these latter and what is worse encroaches on cultivation. In such places the funds required for removal with the chemicals would be too large and even if they were available, the labour required may not be readily available. In such places insects may be introduced.

In the State the insects have been introduced so far in the following places:—

October 1926.—Baigur, on the Nanjangud-Gundlupet Road. On cactus about the small tank near the Police Station.

Nanjangud town in the Chamarajnagar road. Within the first mile.

December 1927.—Yelandur town, within three furlongs on the road to Chamarajnagar.

December 1927.—Ganjam village near Seringapatam.

December 1927.—The Rumalasagara Chathra village, 6 miles from French Rocks. French Rocks town itself, near the two small culverts on the road to Krishnarajapet.

1926.—Bangalore City, on the road to Anekal near the Ookad.

1927.—Kolar Town opposite the Mission Hospital.

In all these places the insects have rapidly multiplied and killed many bushes but it has not spread rapidly. Half to two furlongs is about the greatest distance the insects have travelled since introduction.

* Mysore Agricultural Calendar, Department of Agriculture, Mysore State.

In Yelandur the spread has been the slowest. It is possible that the alkaline character of the soil there has something to do with it. This is however no more than a surmise. It need hardly be pointed out that the destructiveness of the insect is likely to vary to some extent with the character of the soil and the climate.

From the six places more especially from Baigur, Kolar and Ganjam the insect has been carried to neighbouring villages by cultivators who observed the havoc caused to cactus by the insect. Baigur has been a source of supply to at least 20 villages and from Kolar two cartloads were taken by the Forest Officer, Kolar, to infect forests in that district.

There are now thus available several sources of supply and those desirous of obtaining them have but to send a man to gather a few branches containing the insect.

To derive the full benefit from the activity of the insect and enable it to kill cactus quickly and over the widest area it possibly can, it is necessary to observe the following precautions. Before describing these, it would be useful to give a brief account of the insect.

The cochineal is a kind of scale insect belonging to the group of bugs among insects and like all bugs feeds by sucking. The female, when full grown, is dark-red in colour and about the size of horse-gram. It has three pairs of legs and a slender beak with which it pierces the skin of cactus and sucks nourishment. The young is, like the adult, oval in shape but flatter (Fig. 1). Soon after it settles down on the cactus branch, it begins to grow white threads from all over the upper side of the body and these grow so thick and long that the full-grown one looks like tiny balls of cotton (Fig. 2*a*), but when this fluff is removed with a pin or thorn the lac red insect underneath may be seen (Fig. 2*b*). The male is different from the female. It is coloured but has a pair of wings and two long white threads springing from the hind end (Fig. 3). It has also two feelers and three pairs of legs. The wings are provided to enable it to fly to the female and pair with her. Though so different from the female, it looks, when young, just like the young of the female but later it becomes longish and the wings grow from the sides. In the meanwhile it also will have made a small cocoon in shape like the cocoons of the silkworm (Fig. 4) and clusters of this may be found in certain seasons on branches of cactus (Fig. 5). The males do not feed in the adult stage unlike the female. Sometimes there are too many of them and the females are too few. Little harm is then done to cactus. When there is an enormous number of males produced they may be seen flying or carried away by the wind from the bush. Each female may produce 200 to 500 young and the life of a female is about 2 months.

In a year there may be as many as six generations so that one female may produce, in the course of one year, 2,000,000,000,000 insects. The precautions to be observed may now be described.

First, in regard to getting the supply, it is necessary to go at a time when the insects are fully ripe, that is to say, when they are about to bring forth young. The insect with its cottony covering would be then about the size of a pigeon pea. If they are taken too early, they will die off. The full-grown insects rarely travel from the point where they have fixed themselves to suck the juice. They will not move even if the branch on which they are is cut. They will die just there, not of course soon after removal, but after a few days. It is the young from the ripe mothers that would transfer themselves to the bush. They wander for some time to select a suitable place and being young they prefer tender shoots of cactus which they can pierce more easily with their beaks. In infecting bushes it would be more helpful to the young insects if the cactus piece is pinned into thorns near tender branches and the bush selected is under shade. The second point to observe is that as already stated, at times males are produced almost exclusively and no females. There is little use in taking cactus branches containing such for infection purposes.

Thirdly, the cactus branch with females may be cut up into small bits of a square inch or two and each piece may be pinned on to a bush. It is not necessary to attach several branches to one bush. Villages getting supplies from Baigur have carried away so much of infected material that there is some likelihood of Baigur ceasing to be a source of supply. It is best to take only as much as is required and no more.

Fourthly, and this is very important, the insect spreads but slowly, the young ones are very small, smaller than the head louse and they take very long to travel even a few yards and there is danger of their being eaten up by their enemies in the course of their wanderings. It has already been said that the maximum spread in two years has been no more than two furlongs. That is because the insects were left to themselves. If, on the other hand, they had been spread by hand occasionally it would have spread very much more widely. What happens when this is not done is that the insects wandering about aimlessly or not moving at all fail to move off from the dying cactus or are captured by enemies. The insects should, therefore, be spread and spread once in about two months. For the young take about that time to reach the adult stage and reproduce. The spreading should coinside with each successive generation. A man should be sent out then to select proper branches, cut them into pieces and pin them on to

bushes which show no insects. In this way the insect will spread very rapidly and cactus may be killed off to a very large extent in a few years. Except for the labour of spreading no cost would have been increased.

There is one point to which reference has to be made for it is often raised, *viz.*, that the insect may attack other plants when there is no more cactus to destroy. This is not likely to happen. The insect is specially adapted to cactus and to one variety of it. It will not thrive even on other varieties; as for example the one called O. Nigricans the kind found in abundance near Kikkeri and in a few other places in the State. On this latter it can live but not multiply so fast as on the common variety. Furthermore the insect has not spread to other plants during the four years it has been in this State nor in Ceylon, where it was introduced two years earlier. The apprehension need not therefore be entertained.

Before concluding it would be well to state that there are two varieties of the common cactus in Mysore. The commoner one has usually yellow spines two at least longer and slightly bent at the tip. The branches are broadly oval and flowers yellow. This is known as O. Dillenii and is the one which may be easily destroyed by the insect. In the variety already referred to, O. Nigricans, the branches are oval too but not so broad; the spines are reddish grey and not bent at the tip and flowers are red. This, as already stated, may not be seriously affected by the insect. The commoner variety O. Dillenii will not however take long to succumb to attack by the insect if it is introduced and spread on the lines indicated above.—*The Mysore Agricultural Calendar*, 1930.

Transplantation of Cereals.

The following announcement has been made in Landtechnik, the press service of the German Reichskuratorium fur Technik in der Landwirtschaft:—

For some years past accounts have appeared in the Technical Press, and frequently also in the daily papers, of fantastic increases in yield (some hundreds per cent) which are stated to result from the transplanting of cereals. The many inquiries received by the Reichskuratorium fur Technik in der Landwirtschaft both from industrial and agricultural circles have shown that the statements have not failed to make an impression. Industrialists wanted to know whether they should turn their attention to the problems involved in cereal transplanting machines, while any agriculturuists hoped that by cereal transplanting they might, through higher yields, put their affairs on a more satisfactory footing.

The agricultural experts of the Reichskuratorium were sceptical of the results of cereal transplanting. All applications for assistance in the development of transplanting machines were accordingly refused. In order, however, thoroughly to test the constantly repeated claims that were being made for the method, the Reichskuratorium decided at the beginning of 1929 to obtain records of the numerous transplanting experiments actually in progress in Germany.

It was possible to arrange for observation to be made in respect of 146 experiments in all. The spacing of the plants varied from 20 by 20 to 35 by 35 cm. Tillering was in all cases extraordinarily good. As compared with the drilled plots the harvest was delayed by from 8 to 14 days. As a result the transplanted plots suffered from the dry period, and it is not impossible that the yields were unfavourably affected thereby. Wherever possible the harvesting of the experimental plots was carried out in the presence of Diplomlandwirt Weiss, a representative of the Reichskuratorium. The samples were sealed up and were later thrashed out in experimental plot thrashing machines. The results were not favourable. Of the 146 experiments, only 32.4 per cent showed a higher yield in the transplanted plots compared with the drilled plots, while 67.6 per cent showed a lower yield. The yield increases were between 0 and 69.2 per cent. Of the experiments in which increased yields were recorded in the case of the transplanted plots, 45.8 per cent showed increases of more than 30 per cent and 54.2 per cent showed increases of less than 30 per cent. In no case did the increase amount to as much as 100 per cent.

Notwithstanding the unfavourable results thus obtained, the investigation should not be brought to an end, since yield incresses of some 50 per cent were recorded in a number of properly controlled experiments under normal conditions, and it is desirable that the conditions of growth under which these yield increases occurred should be determined. At the request of the Reichskuratorium, the experiments will be continued by the Landwirtschaftliche Hochschule, Berlin (the Berlin Agricultural College).

The results of the investigations up to date indicate that the value of the transplanting of cereals must be regarded as negative, as far as practical agriculture is concerned.—*The Journal of the Ministry of Agriculture*, Vol. XXXVI, No. 12.

Herd Sires.

By Theo. S. Gold,

President, Connecticut Holstein-Friesian Association.

Genetics is that branch of biology that treats of heredity of the coming-into-being of a complex of inherited traits, functions and form, which we call a new individual. The animal breeder is of necessity a sort of empirical geneticist, for his trial and error method is an unconscious application of genetics and furnishes the basis on which genetics is founded.

Genetics has to-day passed the empiric stage, however, and is ready to begin leading the breeder, if he be but willing.

Very roughly the accepted theory of the method of heredity is that every cell comprising an individual contains two determiners for each heritable characteristic. When a cell divides, the determiners divide. In the formation of sex cells, however, one peculiar cell division occurs. At this time the determiners do not split with the cell, but separate. Consequently each sex cell—sperm or ovum—has only one determiner for a given characteristic. The union of a sperm from the sire and an ovum from the dam gives rise to the initial cell of a new individual, with a full complement of determiners—one for each characteristic coming from each parent.

When the two determiners are alike, of course they set the nature of their given characteristic. Also the individual will transmit that characteristic to all its offspring. If the two determiners are different, however, one will be dominant and will set the characteristic for the individual, suppressing the recessive determiner. This individual will have half of its sex cells carrying the dominant determiner, half the recessive. Consequently half its offspring will inherit a characteristic that did not show in the parent. In order that a recessive characteristic may appear in an individual, it must be inherited from both parents.

Production—and type—in dairy cattle is determined by a great many pairs of determiners, with always the possibility of a dominant or recessive. To be sure no potentiality for production can be realized without proper development, but this matter is strictly in the hands of the breeder, and I shall not discuss it. Since a recessive characteristic may not show in a given animal, the only sure way to know what a bull or cow will transmit is to watch its offspring. One or two offsprings do not give an index of a parent for they inherit from two parents, and inherit but half of either parents' hereditary possibilities. Since to know

anything about a heifer's production we must wait until the end of her first lactation, since a cow does not usually have all daughters and since a cow's life is generally not over ten to fifteen years, we cannot learn much about a cow through progeny testing till the cow is gone.

It is possible, however, to prove a bull. It is generally accepted that the production records of six to eight unselected daughters will give a fair idea of a sire's transmitting ability. That means that it is quite possible to know a bull's worth by the time he is five years old. He then has every prospect of five to ten years of active service before him.

Sires are occasionally found all of whose daughters are high producers regardless of the dams. Bearing in mind the facts of genetics mentioned above, it is clear that such a sire must have a full complement of dominant determiners for high production. All his sex cells are alike in this respect, and all his offspring must have at least one dominant determiner—the one from him—in each pair.

Let us see what would happen if a series of such sires were used on one another's daughters. Based purely on mathematical chance, if all the daughters of the first sire have at least one dominant determiner in each pair of all their daughers by the second sire, one-half would have two dominant determiners as a pair. The next top-cross of a proven dominant sire would give a group of daughters, three-quarters of which would be purely dominant. Now when purely dominant animals are bred together only dominant offspring can result. It becomes apparent that by continued use of proven sires a strain can be developed wherein all individuals will inherit the capability for high production, will continue to breed true while mated *inter se* and will produce a first generation of all high producers when bred to unselected stock.—*Holstein Friesian World*, Vol. XXVII, No. 16.

The Advantages and Limitations of Labour-Saving Machinery.

It will help in this campaign for the intensive machanization of agriculture if farmers, as well as inventors and manufacturers, will approach the matter in the right spirit. That is to say, farmers themselves must not only be more receptive to new ideas, but they must also be more encouraging to inventiveness and less exacting in the earlier stages. At the moment there is a belief in some quarters that unless machinery can produce work of the same exactitude and precision as hand labour it does not provide an effective substitute. That may possibly be a charge, for example, in the equipment of a machine shop,

where the factors are more or less constant, but it cannot justifiably be applied in the case of farming, where conditions are so unequal and factors constantly changing. The two cases cannot be judged on the same basis, for it has to be recognized that in agriculture there is wide scope for the application of machinery that saves labour without, at the same time, quite producing the same fineness of the product. The matter is put concisely by a comparison, which has often been made, between the spade work of the gardener and the ploughing of the man with the more extensive area to turn over. Ploughing in actual tillage action is notably inferior to spade work, but who can afford in these days of high labour costs to have any expansive fields turned over with the spade? Thus we get the reason for ploughing large acreages and, logically enough, the next step is the speedier ploughing of the same fields, thereby bringing about by implements and machinery of a more modern type—a result that, economically, if from no other standpoint, is far and away superior to handwork. And as it is the economic criterion which is the only one of any value these days, so must the logic of the plough and the spade be applied in other directions. It is no use bemoaning, as we heard some farmers do the other day, that handwork is more discriminating and more highly finished than machine work. That argument has all the bottom knocked out when it is realized that hand labour is unduly expensive in many instances, is growing more so in the case of market garden and other crops, and is inclined to be difficult to get, if not also difficult to control. We are not suggesting that all labour is intractable, but some of the skilled workers are assuming an independence born of the new conditions and that does not tend to ease the position. Therefore, the advent of any machine, which seeks to do work on a more economical and reliable basis than what has hitherto been possible, should be welcomed as a sign that the times are arriving when the farmer will be able to employ labour to better advantage through the use of better equipment, and will no longer be worried by the troubles arising from a gradually diminishing supply of skilled craftsmen. The mechanization of agriculture must, in consequence, proceed along the lines of greater economy of production, and so long as that aim is kept in view, nothing but substantial progress will be made.—*The Implement and Machinery Review*, Vol. 56, No. 663.

Nutmegs (*Myristica fragrans*).

The nutmeg is a bushy tree about 30 to 40 feet in height, a native of the Moluccas, and introduced into Penang in 1798. The tree is cultivated for the nutmeg and mace of commerce, the chief countries in which it is grown being Banda, Sumatra, Java, Amboyna, Penang, Celebes, the Moluccas and the West Indies.

Cultivation.—The nutmeg is usually cultivated on hillsides from about 200 to 1,500 feet, but is rarely found growing at sea level.

In Penang in which are produced the finest nutmegs in the world, the trees are grown on the steep, exposed slopes of granite hills on which the soil consists of yellow loamy clay, characteristic of the laterite formations of the Malay Peninsula. Bare clay slopes or sandy soils are considered unsuitable, whilst wet or low lying ground is fatal to its growth.

The nutmeg is propagated from seed; only large well-formed seeds should be selected for this purpose. Seeds of irregular shape, or of a pale colour, should be rejected; also those which rattle in the shell on shaking. The seed should be planted as soon as possible after collection since it loses its vitality quickly.

The seed is planted in well-prepared nursery beds, composed of good soil, at distances of about 12 to 15 inches apart and at a depth of two and a half inches. The beds should be shaded and watered every other day, or more frequently if necessary. The seeds germinate usually in four to six weeks. It is advisable to reduce the shading of the nurseries gradually. The young plants remain in the nurseries till they are from six to nine inches high, or for a period of about six months, after which they are transplanted. Planting in baskets is sometimes practised with good results.

The young seedlings are planted in the field at a distance of twenty-five to thirty feet apart. The holes for planting should be at least three feet wide and three feet deep, and filled with good surface soil and leaf mould. The tap root should be kept straight, the soil in the hole well pressed around the root and filled slightly above the level of the surrounding ground to allow for sinking. In hot and exposed situations the plants require shading until they have become established, but the shade can usually be removed after ten to fourteen days. Although permanent shade in the form of light-foliage trees is considered advantageous to the nutmeg, the trees in this country are frequently grown in the open.

After the plants are established, they require very little attention beyond keeping the ground clear of weeds around the trees. Mulching with cut grass or light manuring with well-decomposed cowdung is very beneficial, particularly on poor soils since the nutmeg is a heavy feeder.

Pruning is seldom necessary, but all dead branches and parasitic plants should be removed.

Since the nutmeg is unisexual, that is, male and female flowers are borne on different trees, the number of male trees should be reduced, if necessary leaving one male to every ten or twelve female trees. Unfortunately, it is impossible to distinguish between the two until they begin to flower.

Yield.—The trees usually commence to fruit between the fifth and sixth year, but may take even eight or nine years to come into bearing. They attain maximum productivity at fifteen years and fruit well for a further ten to twenty years. Trees which commence to fruit early are invariably very shortlived. The fruit is sometimes allowed to fall, but it is preferable to collect it from the tree, using if necessary, a hooked stick to pull down the higher branches. A good worker in the full fruiting season will collect from 1,000 to 1,500 fruits per day.

The tree fruits throughout the year, but the heaviest crop is obtained usually in July and August. The whole fruit consists of three parts : (1) the husk, (2) the mace, and (3) the seed or nutmeg of commerce.

The yield of nutmegs from individual trees varies considerably but good trees should average 1,500 to 2,000 fruits a year. A yield of 750 lbs. of nutmegs and 120 lbs. of mace per acre is, however, considered satisfactory under ordinary conditions.

Preparation of Nutmegs and Mace.—A few days after collecting the fruits burst open and the mace is detached from the seed by opening it from the top and turning it back. The fresh mace is of a brilliant red colour, rather tough and leathery, and possessing a peculiar turpentine odour. After removal the mace is flattened out either by hand or between boards. It is then placed in the sun for a few hours each day until dry, which takes from ten to fourteen days.

The husk and mace having been removed, the seed, which is still in the shell, is dried in the sun in the same way as the mace. When the seeds are dry they rattle in the shell on shaking and are stored in the shells. As soon as sufficient stocks have been obtained, the shell or seed coat is cracked, which is done either by striking one end with a wooden mallet, or more economically by machinery. After the seed is

removed from the shell it is very liable to the attacks of insects, especially if stored for any length of time.

Nutmegs are valued according to size; and, after cracking, they must therefore be graded. The three common grades are those averaging 65, 85 and 110 nuts per lb. respectively. Defective or broken nuts are converted to powdered spice by grinding, and used for seasoning or preparation of nutmeg butter and essential oil of nutmegs.

The grade nutmegs are packed in cases or casks for export.

Uses.—The nutmeg contains about 25 per cent of a fixed fat which constitutes the nutmeg butter of commerce, prepared by crushing the seeds and pressing the heated meal.

The nutmeg also contains an essential oil, which is obtained by steam distillation of the pulverized nutmegs, the yield being from eight to ten per cent. Mace also yields an essential oil related closely to that of the nutmeg.

Both nutmegs and mace are used principally as spice and flavouring agents; nutmeg butter is used medicinally as a basis for ointments, whilst oil of nutmegs or mace is employed in perfumery and for flavouring liquers.—*Handbook of Malayan Agriculture.*

Science of Nutrition—its Importance to India.

By Lieut.-Col. R. McCarrison, c.i.e., m.d., ll.d., f.r.c.p.

I have chosen to speak on Nutrition, believing that for no country in the world has this science a greater importance than for India; and for no part of India a greater importance than for the Madras Presidency. No country has more need to profit by the newer knowledge of Nutrition, and none more opportunity to add to it. Millions of the Indian people are living on restricted diets which are either incapable of maintaining them in a state of normal nutrition and health, or capable only of sustaining them at a low level of physical efficiency. Malnutritional diseases are rife, while the great scourges of the Tropics—malaria, cholera, dysentery, leprosy—exact an immense toll from India's malnourished multitudes. In this Presidency alone 'deficiency diseases' of almost every kind abound and the level of physical efficiency of the masses is, in general, low. But while this is so in certain parts of the Peninsula there are others where the inhabitants are unsurpassed by any race of mankind in physique and capacity for endurance and hard work. Nowhere is the composition of human dietaries more influenced by racial, religious, economic and climatic considerations and nowhere have foods and food habits remained more consistently the same from one generation to another. So it is that the diverse races, comprising the population of

India, afford an unrivalled and, almost wholly unexplored, source of information regarding the effects of diet on the physical efficiency of human beings. India has thus not only much to do in applying the newer knowledge of Nutrition and in surveying, in the light of this knowledge, the foods available for the use of her immense populations, but much to learn regarding their nutritional needs, and much—by such learning—to teach the rest of the world.

I venture to hope that the subject may prove of interest to Government officials, businessmen, private individuals and members of the medical and other professions. In one way or another—social, political, economic, mercantile or hygienic—Nutrition is a matter that affects them all: the medical man, perhaps more than any other since his intimate acquaintance with it provides a shrewd instrument wherewith 'to tune this curious harp of man's body and reduce it to harmony'.

Let me, in as few words as I can, endeavour to explain to you why this is so.

'La vie est une fonction chemique' (Life is a chemical function), so said Lavoisier in 1780. (He it was who inaugurated the modern era of the Science of Nutrition and who first applied the balance and the thermometer to the investigation of the pehnomena of life. He was executed by the 'powers-that-be' of his time. But his work still lives and that of to-day is but a continuation of it.) To his dictum it may be added that everyone of the myriad cells of which the body is composed is a chemical laboratory wherein the materials provided by the food, are, with the aid of the oxygen derived from the respired air, broken down or built up into substances required for the nurture and energizing of the body as a whole. The sum of these chemical changes—whereby the function of nutrition is effected—is known as metabolism: health accompanies its perfection, ill-health is the sequel of its imperfection.

The food, then, must provide all the substances needed by the living cells for the proper exercise of their chemical processes: there must be none that are in deficiency and none, if the cells are not to be burdened with a maximum of labour, that are in excess. For, if there be some that are deficient or lacking in the food, then do the chemical changes with which these substances are concerned become impaired or fail; with the resultant impairment or failure in function of some corresponding organ or tissue of the body. While, if there be some that are continually in excess, certain cells will ultimately fail from exhaustion brought about by overwork, and disease of the corresponding organ or tissue will result. There are thus two directions in which nutritional disorders may arise: the one by deficiency of essential elements in the

food; the other by excess of certain ingredients of the food; and these two, by their combination, may provide a third. The ideal food is, therefore, a palatable mixture of essential foodstuffs arranged in such proportions as to satisfy every need of the body without overburdening it with work.

The essential foodstuffs are nitrogenous substances called proteins, starches and sugars, called carbohydrates; fats; mineral salts and water. The amounts of these required for each sex, from infancy to old age and under varying conditions of rest, work, climate and temperature are now fairly well known though there is still much to be learned especially in regard to the quantities of them that are needed in tropical countries for various classes of labour. All these foodstuffs exist, some in greater proportion than others, in the food materials which Nature provides for our use: the proteins principally in animal foods, such as meat, fish, fowl, egg and milk but also in vegetable foods, such as pulses and cereal grains, though in less suitable form and in less proportion than in animal foods. The carbohydrates exist principally in vegetable foods, such as cereal grains, root-vegetables and fruit; the fats in the flesh of animals, milk, egg and certain fish as well as in various nuts and seeds; while the mineral salts—of which there are some 20 essential kinds—are derived both from animal and from vegetable sources. The essence of successful nutrition is so to combine these natural foods as to provide a sufficiency of all essentials without excess of any.

The five essential foodstuffs or 'proximate principles' as they are called—proteins, carbohydrates, fats, mineral salts and water—can be prepared in the pure state and set out, as it were, in bottles in one's laboratory bench. Not so very long ago—only a few years before the Great War, in fact—it was thought that these 'proximate principles' were all that the body needed for the normal processes of Nutrition. But it was found by Gowland Hopkins of Cambridge, that if they be combined in due proportion and given as food to young rats—the animals usually employed for nutritional work—the food mixture did not admit of growth nor sustain life. But if to it a little whole milk were added then growth proceeded and health was maintained. Later it was shown that if the milk were subjected to heat, in the presence of air, growth again failed and the animals died. There was 'something' in the milk other than proteins, fats, carbohydrates, salts and water, which was essential to life. The something is 'vitamin'. Soon it became known that there are more vitamins than one: some soluble in water, others soluble in fats; some destroyed by heat, oxidation and

certain chemical agents, others not; some contained in one kind of food material, others in another. To distinguish them they were named after the letters of the alphabet and designated vitamin A, B, C, D and E. At the present time there are known to be six: B having recently been divided into two (B1 and B2). Twenty years hence this number may have increased several-fold. But whether there be six or sixty they will all be found to exist in the simple foods made in Nature's Laboratory —whole cereal grains, milk, milk products, fresh fruit, and green leafy vegetables—and in quantities and combinations adequate for the due digestion and assimilation of the natural foodstuffs with which they are associated in Nature. Their multitude need cause the layman no anxiety provided he remembers that it is only by the purification, sophistication, storage and excessive cooking of Nature's foods that they become deficient in these elusive and most necessary substances. Now-a-days it is possible to buy concentrates of some of them over the counter of druggists' shops, but the wise man will rely on Nature and not on the druggist for their provision; for no synthetic diet, which it is possible to prepare in the Laboratory, is in my experience as good as one made from a proper combination of natural foods.

The 'proximate principles' are the substances from which the body is built and repaired and from which it derives energy and warmth: the vitamins are substances which enable these principles to be properly utilized. Some years ago I likened the action of vitamins to that of the spark which ignites the fuel mixture of a petrol-driver engine liberating its energy. The spark is of no use without the fuel nor the fuel without the spark; nay, more! the efficacy of the spark is dependent on the composition of the fuel-mixture. This simile has its limitations: but so far as it is applicable it will serve to fix the function of vitamins in the mind.

With the discovery of 'vitamins' and with more exact methods of experimentation, knowledge of nutrition progressed rapidly: experiments, as is the way of science, revealing causes and causes inventing new experiments. Presently there arose the conception of disease as being due to negative as well as positive causes: a conception slow to gain general acceptance no doubt because 'it is the peculiar and perpetual error of the human intellect to be more moved and excited by affirmatives than by negatives; whereas it ought properly to hold itself indifferently disposed to both alike! (Francis Bacon). At the present time there are few who would dispute the influence of either. The negative factors are lack or deficiency of certain essential elements in the food; the positive factors are, for the most part, pathogenic agents such as bacterial

and protozoal organisms. Sometimes one or other of these factors may operate alone in disease-production, but more often they join forces. And it is not only in those whose food is insufficient in quantity, but in many whose food is sufficient or even excessive in quantity while lacking in quality that these forces operate to cause disease.

Let me now attempt to describe the sequence of events leading to disease as a result of deficiency of a single factor in the food. For this purpose I shall choose 'vitamin A' one of the most common of all deficiencies in the dietaries of India's inhabitants: indigenous as well as non-indigenous. But before I do so I would emphasize that it is rare to find only one substance deficient in a diet; more often there are several and more often still the deficiencies of some essentials are combined with excess of others. Balance of the food in every essential is a principle as important as the avoidance of deficiency in any. And if I select for this story of pathogenesis a Vitamin-deficiency, it is not to say that an equally impressive one could not be told in regard to deficiency of some 'proximate principle' such for example, as of the mineral elements: lime, phosphorus, iron or iodine. To limit my story to a reasonable compass I will not only select a single deficiency—vitamin A—but will tell of its effects on only one tissue of the body: mucous membrane. As you know it is with mucous membrane—a highly specialized skin—that various cavities and passages communicating with the outside air are lined; the conjunctiva, the alimentary tract, the passages from the kidneys to the bladder, the bladder itself and the respiratory passages. To protect it, and through it the body, against attack by pathogenic organisms, Nature has endowed mucous membrane with a very wonderful defence mechanism. It is unnecessary to enter on a description of this mechanism, suffice it to say that the cells covering the mucous membranes produce certain secretions and possess certain qualities antagonistic to harmful bacteria. When vitamin A is absent from, or deficient in, the food, the cells covering the mucous membrane dry up and become what is called keratinised (horny). The mucous and other secretions are either no longer produced or such as are produced are lacking in protective quality: the outward defence of the body are thus broken down, and a door is opened for the entry of bacterial and other pathogenic agents into the tissues of the body. This door they are not slow to use. When this sequence of events takes place in the conjunctiva and the near by tear-producing glands (mucous membrane connecting inner eyelid and eyeball), infection of the eye is likely to occur, especially in a dusty land like India, and the whole organ may be rapidly invaded and destroyed. In this Presidency alone there are thousands of people

who have been wholly or partially blinded in this way. Your distinguished ophthalmologist—Lt.-Col. Robert Wright—has recently emphasized this cause of blindness in Madras: a cause discovered by patient experiment on rats. Or if the respiratory tract be affected in a similar way the bacteria which cause such diseases of the lungs as pneumonia and tuberculosis have the way made ready for their ravages. Herein is one cause of the wide prevalence of tuberculosis and an illustration of the way in which dirt and diet combine to cause disease. Or if the urinary tract be similarly involved infection is likely to occur therein, chemical changes are brought about in the urine, and its contained salts and other substances no longer remain in solution but are deposited in the kidney or bladder with the formation of that common and distressing malady: 'stone'. In my own laboratory stone-in-the bladder and kidney have been produced in this way and prevented as easily by adding whole milk containing vitamin A, to the stone-producing diet; while many disorders of the gastro-intestinal tract have been shown to have a like causation.

There is no organ nor tissue of the body which is not affected in some similar kind of way by one deficiency or another or by the combined action of such deficiencies and pathogenic agents: the nerves, the bones and teeth, the stomach and intestines, the reproductive glands, the thyroid, the adrenals, the liver, the kidneys, the spleen, the blood and skin. And according as one or other or several of these are affected there appear certain clinical pictures which we recognize as disease entities: keratomalacia, beri beri, scurvy, rickets, osteomalacia, pellagra, anæmia and so on. But underlying them all, and causing many conditions of ill-health for which we, as physicians, have no hagnostic label, there is depreciation of chemical and cellular functions: the foundation upon which disease is built.

Not long ago I had occasion to survey the incidence of lung diseases in the rats I use so largely for experimental work. I found in 2,000 odd post-mortem examinations carried out in deficiently fed animals that no less than 35 per cent had died of lung diseases; while in an average daily population of 800 or more well-fed animals the incidence of lung disease was less than one per cent. An observation of this kind has an immense significance. The final cause of the lung disease was a microbic agent but it was the defective food which enabled it to overrun and kill the host. Ten years ago I made a similar observation in regard to dysentery. Such experiences lead one to think that sometimes we, as physicians and investigators of disease, fail to see the wood for the

trees and that by singling out for meticulous study the pathogenic organisms associated with certain diseases we often neglect to consider the influence on their growth and disease-producing potency of the human soil in which they may become implanted. For myself I do not doubt but that faulty nutrition is the prime means whereby the soil is made ready for the rank growth of morbific organisms.

It is not only in regard to man but in regard also to his domestic animals that the study of nutrition is of such vast importance. Time does not permit me to dilate on the veterinary and stock-rearing aspects of the matter. It is sufficient to say that animals are no less subject to dietary diseases than man himself and that the future of the Veterinary Science, like the future of Medical Science, lies largely in the study of nutrition. Nor do the ramifications of the science of nutrition end with man and his domestic animals: they extend to his crops and to the very soil itself. Soil, irrigation, manure: all these have their influence not only on the quantity but on the quality of the crops as food. So it is that nutrition has its human, its animal and its plant aspects and its proper study must embrace them all.

In this brief sketch of so wide a subject I trust I may have said enough to convince you that it is one having an interest for everyone; laymen as well as medical men; rich as well as poor. Fortunately, like the principles of true religion, those of nutrition are simple and easy of comprehension. It is not my purpose here to expound them. I have done so lately in a little book called "Food", which, I hope, some of you may be sufficiently interested to read. It is the answer, so far as I am able to give it, to a question put to me twenty-seven years ago. At that time, and shortly after my entry into the Service, I had in the Hindu Kush my first private patient: a Mullah whom I afterwards came to number amongst my friends. He was suffering from 'gravel'. Ripe from the University and full of the medical lore of my day I disposed of his case with the confidence of youth, insisting magisterially on a certain line of treatment. He heard me with becoming courtesy not to say deference and then remarked: 'But Sahib, what shall I eat?' I did not know! I had been taught much, some of it of doubtful utility, but not this essential thing. Now after 27 years devoted to research some glimmering of the predominant part played by diet in causing his condition is being revealed to me. But still his salutary question—'what shall I eat?'—recurs to me in connection with many other states of ill-health; and I realize that my days of research must come to an end before I can learn its complete answer. 'What shall I eat?' is a

problem that has exercised the minds of many since the dawn of Medical History. Its full solution lies in the future and goes to the very root of Medical Science. Indeed the prophetic words of Hippocrates spoken in regard to the nutritive quality of different breads, are as apt to-day as they were 2,000 years ago: 'Whoever pays no attention to these things, or paying attention does not comprehend them, how can he understand the diseases that befall a man?'

In view of the importance of this subject is it not a little remarkable that while India—and to go less far afield: Madras—has her great and essential organizations dealing with the nurture of the fruits of the earth and of the trees of the field, she has, as yet, none dealing with the nurture of man himself and of his domestic animals? It is true that she has her Medical, Veterinary and Public Health Departments: all beneficent in their own sphere and effecting great good. But the two first are for the most part engaged in the salvage of wrecks, while the last, though brilliantly successful at times in its skirmishes with disease, must continue to fight a losing battle until it is recognized that malnutrition is the root cause of the vast proportion of human and animal disease in this country, and until means are found for improving the standard of the living of the masses.

What then should India, what should Madras, do in this matter? Mindful that the business of the Scientist is to stick to his Science, I say nothing of means for improving the standard of living of the masses; but there are two adjuvants to that end: education and the development of Research. India should see to it that the elements of Nutrition are taught in her schools and that this subject occupies a prominent place in the medical curriculum of her Universities. She should find amongst her own sons and daughters those capable of undertaking, and desirous of devoting themselves to, Nutritional Research; those actuated by the spirit of inquiry and possessed of a fitting humility, 'the entrance into the kingdom of man, founded on the Sciences, being not much other than the entrance into the Kingdom of Heaven, whereunto none may enter except as a little child' (Bacon). Following the example of Japan she should house these votaries of Science in her own National Institute for Nutrition, where they are taught, trained and tried and where they in their turn train and teach; where every aspect of Nutrition is ardently explored; 'where tireless striving stretches its arms towards perfection; where words come out from the depths of Truth; where the clear stream of reason has not lost its way into the dreary desert sand of dead habit' (Tagore).—*Madras Agricultural Journal*, Vol. XVII, No. 10.

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